and ferrites. Also conductive surface coatings can be used. Precious metal coatings include, but are not limited to, silver, gold and precious metal alloys (see, U.S. Pat. Nos. 4,923,739 and 4,737,112 incorporated herein by reference).

[0030] In certain embodiments, the conductive region can be a substrate, such as a particle, coated with metal. Suitable substrates include, but are not limited to, glass, silicon, quartz, ceramic or combination thereof

[0031] The present invention has advantages over current sensor technology. One advantage is the use of lower concentrations of particles, which leads to ease of dispersion. To a first approximation, the rate of particle sedimentation is proportional to the number of particles in the dispersion. Another advantage is the increased stability of the sensors of the present invention, especially when the polymer matrix is crosslinked (i.e., the polymer molecules are interconnected forming a 3-dimensional network). A third advantage is an increase in the sensitivity of the sensors leading to lower limits of detection (i.e., increased dynamic range). The latter advantage is due to the much higher signal-to-noise ratio given by the sensors having an aligned conductive region.

[0032] More particularly, the major advantage of this invention over the sensors of the prior art is that the signal-to-noise ratio is much higher. Because of the increase in the signal-to-noise ratio, the limit of detection increases (i.e., a smaller concentration of analyte is capable of detection). In addition, the response time is faster. A faster response time is critical in applications such as quality control where the analyte may be on a conveyor belt with a very short time for detection. In general, sensors with greater response times are better than sensor with lower response times. Various sensor responses of the present invention include, but are not limited to, resistance, capacitance, inductance, impedance, and combinations thereof.

[0033] In certain aspects, the nonconductive region of the sensors comprise an organic material. In certain preferred aspects, the organic material is an organic polymer. Organic polymers suitable for use in the present invention include, but are not limited to, those set forth in Table 1.

TABLE 1

Major Class	Examples
Main-chain carbon polymers	poly(dienes), poly(alkenes), poly(acrylics), poly(methacrylics), poly(vinyl ethers), poly(vinyl thioethers), poly(vinyl alcohols), poly(vinyl ketones), poly(vinyl halides), poly(vinyl nitriles), poly(vinyl esters), poly(styrenes), poly(arylenes), etc.
Main-chain acyclic heteroatom polymers	poly(oxides), poly(carbonates), poly(esters), poly(anhydrides), poly(urethanes), poly(sulfonates), poly(siloxanes), poly(sulfides), poly(thioesters), poly(sulfones), poly(sulfonamides), poly(amides), poly(ureas), poly(phosphazenes), poly(silanes), poly(silazanes), etc.
Main-chain heterocyclic polymers	poly(furan tetracarboxylic acid diimides), poly(benzoxazoles), poly(oxadiazoles), poly(benzothiazinophenothiazines), poly(benzothiazoles), poly(pyrazinoquinoxalines), poly(pyromellitimides), poly(quinoxalines), poly(benzimidazoles), poly(oxindoles), poly(oxoisoindolines), poly(dioxoisoindolines), poly(triazines), poly(pyridazines), poly(piperazines), poly(pyridines), poly(piperidines), poly(triazoles), poly(pyrazoles), poly(pyrrolidines), poly(carboranes), poly(oxabicyclononanes), poly(dibenzofurans), poly(phthalides), poly(acetals), poly(anhydrides), carbohydrates, etc.

[0034] The sensors of the present invention can be fabricated by many techniques including, but not limited to, solution casting, suspension casting, matrix assisted pulsed laser evaporation (MAPLE), MAPLE-Direct Write (MAPLE-DW) (see, R. Andrew McGill, et al., *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control* 45:1370-1380 (1998), and mechanical mixing. In general, solution casting routes are advantageous because they provide homogeneous structures and are easy to process. With solution casting routes, resistor elements can be easily fabricated by spin, spray or dip coating. Since all elements of the resistor must be soluble, solution casting routes can be somewhat limited in their applicability. Suspension casting still provides the possibility of spin, spray or dip coating, but more heterogeneous structures than with solution casting are expected. With mechanical mixing, there are no solubility restrictions since it involves only the physical mixing of the resistor components, but device fabrication is more difficult since spin, spray and dip coating are no longer possible. In certain embodiments, the resistor is deposited as a surface